

Remarks

Summary

Claims 1-20 were pending. Claims 1, 8, 12, 15 and 19-20 have been rewritten and Claims 21-26 added. No new matter has been added.

Rejection of Claims

In the Office Action, Claims 1-3, 8-10, 12-13, 15-17 and 19-20 were rejected under 35 U.S.C. §102(b) as being anticipated by Ravkin (U.S. Patent 6,123,607), Claims 1-2, 4-5, 7-9, 11-12, 14 and 20 were rejected under 35 U.S.C. §102(b) as being anticipated by Smith (U.S. Patent 5,484,323), and Claims 1-2, 4-9, 11-12, 14-16, 18 and 20 were rejected under 35 U.S.C. §102(e) as being anticipated by Lacy (U.S. Patent 6,554,688). Claims 1, 8, 15 and 20 have been rewritten to better clarify the invention to which the claims are directed. Claims 12 and 19 have been rewritten to correct an obvious typographical error.

Claim 1 recites an apparatus for conditioning a polishing pad used in chemical mechanical planarization (CMP) of semiconductor wafers. The apparatus has several features:

- 1) The polishing pad has first and second points that travel at first and second velocities (v_1 and v_2), respectively.
- 2) The conditioning member engages a surface of the polishing pad to be conditioned.
- 3) The conditioning member includes a primary edge and an opposing secondary edge.
- 4) The first and second points define first and second paths of first and second lengths (L_1 and L_2), respectively, across the conditioning member as the points travel in the forward direction from the primary edge to the secondary edge.
- 5) These paths are non-intersecting.
- 6) $v_1 \times L_1$ is substantially equal to $L_2 \times v_2$

Ravkin: The Examiner states that the conditioning member of Ravkin (conditioning arm 40) engages the polishing pad 43. However, it is not the conditioning arm 40 that engages the surface of the polishing pad to be conditioned but the end effectors 44, 46 that engage the surface. Moreover, the end effectors are described as being rotated by a motor, rotor or other means (col. 5, lines 64-65) whereas the conditioning member of Claim 1 of the instant application is non-rotatable. Ravkin, to the contrary, teaches that the conditioning arm is rotatable (see e.g. Figs. 4A and 4C).

While these end effectors 44, 46 may engage the surface, because the polishing pad is a linear belt, points along the belt traveling in the forward direction have the same velocity. This means that for $v_1 \times L_1 \approx L_2 \times v_2$ the first and second paths along the end effectors must have the same length. However, the only paths along the end effectors that have the same length are positioned such that the paths intersect, unlike the arrangement recited in Claim 1 of the instant application, which recites that such paths do not intersect.

Thus, for at least these reasons, Ravkin does not anticipate or disclose the arrangement of Claim 1. Thus, Claim 1 is patentable over Ravkin.

Similarly, Claim 8 recites that the opposing primary and secondary edges of the conditioning member are parallel and in contact with a surface of the polishing pad to be conditioned. However, as above Ravkin discloses that the end effectors, not the conditioning arm, contact the conditioning member. Furthermore, Ravkin discloses that the opposing primary and secondary edges of each of the end effectors are not parallel with each other. Nor does Ravkin even teach edges of the different end effectors that are both parallel and oppose each other.

Thus, for at least these reasons, Ravkin does not anticipate or disclose the arrangement of Claim 8. Thus, Claim 8 is patentable over Ravkin.

For similar reasons to those given for Claim 8, Ravkin does not anticipate or disclose the arrangement of Claim 20. Thus, Claim 20 is patentable over Ravkin.

Claim 15 is also patentable over Ravkin for similar reasons as those provided above. Thus, for at least these reasons, Ravkin does not anticipate or disclose the arrangement of Claim 15. Thus, Claim 15 is patentable over Ravkin.

Claims 1, 8, and 20 are patentable over Smith. Smith teaches a belt cleaner to clean a sanding machine, not an apparatus for conditioning a polishing pad used in chemical mechanical planarization of semiconductor wafers. More specifically, as recited in the claims of the instant application, the conditioning member is configured to engage a surface of the polishing pad and form at least one microchannel in the surface for slurry transport and removal of debris or byproducts generated during the CMP process. This is wholly unlike the arrangement of Smith, who teaches a belt cleaner that is configured to clean bits of wood and wood resins from the surface of the belt.

Claims 8 and 20 are additionally patentable over Smith as Smith teaches that the portion of the conditioning member actually engaging the belt in Smith is curved, directly opposite the arrangement in Claims 8 and 20 in which the primary edge is generally parallel to the secondary edge.

Thus, for at least these reasons, Smith does not anticipate or disclose the arrangement of Claims 1, 8, or 20. Thus, Claims 1, 8, and 20 are patentable over Smith.

Similarly, Claims 1, 8, 15, and 20 are patentable over Lacy. As above, these claims recite that the conditioning member is configured to engage the surface of the polishing pad to be conditioned. Lacy, on the other hand, teaches directly away from such an arrangement, teaching instead a conditioning member that does not contact the surface of the polishing pad to be conditioned in order to avoid excessive wear of the surface. To this end, if Lacy contacts a surface, it is not the surface of the polishing pad to be conditioned, but rather the opposing surface (which is under the surface of the polishing pad to be conditioned).

Furthermore, Claims 1 and 8 are patentable over Lacy in that Claim 1 of the instant application recites first and second paths that are traced across the conditioning member from the primary edge to the secondary edge as first and second points of the polishing pad travel in the forward direction. Lacy does not teach the existence of such opposing primary and secondary edges. Moreover, as shown in Figs. 3 and 7, Lacy teaches that the curved surface of a sonic source may contact the underside of the polishing pad. In the curved surface illustrated in the figures of Lacy, essentially only a

single point contacts the polishing pad. Thus, unlike the arrangement recited in Claim 1 of the instant application, in Lacy no path could be traced from a primary edge to a secondary edge.

Claim 8 recites opposing primary and secondary edges that both contact the polishing pad, a feature not disclosed by Lacy. For similar reasons, Claims 2-6, 9-11, 16-18 are patentable over Lacy as they further serve to limit the arrangement of the primary and secondary edges. For example, Lacy does not anticipate or disclose an arrangement in which the primary and secondary edges are both in contact with the polishing pad and are curved, as recited in Claim 11 of the instant application.

Similarly, Claim 15 is patentable over Lacy at least because the conditioning member does not engage the surface of the polishing pad to be conditioned (as shown in Fig. 16 of Lacy). Rather, a high pressure stream may engage the surface of the polishing pad to be conditioned (see col. 8, lines 32-59).

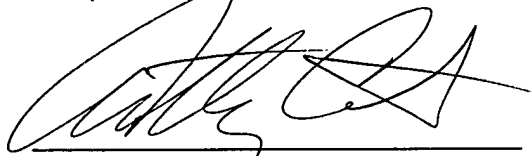
Thus, for at least these reasons, Lacy does not anticipate or disclose the arrangement of Claims 1, 8, 15 or 20. Thus, Claims 1, 8, 15 and 20 are patentable over Lacy.

In addition, new Claims 21-26 have been added. Claims 21-26 are independently patentable over the references. For example, Claim 21 recites that the conditioning member is mounted along an axis passing through the center of the polishing pad. Ravkin and Lacy, in contrast, both teach an arrangement in which the conditioning arm is mounted along an axis far from the center of the polishing pad. Similarly, Claims 22-24 recite specifics regarding the distance between the primary edge and the secondary edge with respect to the distance from the center of the polishing pad. None of the cited references anticipate or suggest that the distance between the primary edge and the secondary edge of the conditioning member changes, let alone any relationship between the distance and the center of the polishing pad.

Conclusion

In view of the claim amendments and arguments above, Applicants respectfully submit that all of the pending claims are in condition for allowance and seek an allowance thereof. If for any reason the Examiner is unable to allow the application in the next Office Action and believes that a telephone interview would be helpful to resolve any remaining issues, he is respectfully requested to contact the undersigned agent or attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Anthony P. Curtis', is written over a horizontal line.

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